TM 5-823-1

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ARMY AIRFIELD-HELIPORT DESIGN

GENERAL PROVISIONS AND CRITERIA

HEADQUARTERS, DEPARTMENT OF THE ARMY

APRIL 1965

TECHNICAL MANUAL)
)
No. 5-823-1)

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D. C., 15 April 1965

ARMY AIRFIELD-HELIPORT DESIGN—GENERAL PROVISIONS AND CRITERIA

This manual supersedes Corps of Engineers Manual EM 1110-3-311. 15 June 1957.

1. PURPOSE AND SCOPE. This manual establishes the general provisions and criteria for planning the configuration, including navigable airspace and clearances, and in designing the pavements for airfields and heliports at Army installations.

2. REFERENCES.

AR 95-50	Airspace Responsibilities and Procedures.
AR 210-20	Master Planning for Permanent Army Installations.
AR 210-30	Selection of Sites for Army Installations.
AR 415-31	Basic Housing and Space Allocation at Permanent Installations.
TM 5-803-1 (EM 210-3-1)	Master Planning Principles and Procedures.

TM 5-803-3 (EM 210-3-3)	Site Planning - General.
TM 5-818-1 (EM 1110-345-147)	Procedures for Foundation Design of Buildings and Other Structures.
TM 5-818-2 (EM 1110-1-306)	Pavement Design for Frost Conditions.
TM 5-820-1 (EM 1110-345-281)	Surface Drainage Facilities for Airfields.
TM 5-820-2 (EM 1110-345-282)	Subsurface Drainage Facilities for Airfields.
TM 5-820-3 (EM 1110-345-283)	Drainage and Erosion Control Structures for Airfields and Heliports.
TM 5-820-4 (EM 1110-345-284)	Drainage for Areas Other Than Airfields.
TM 5-822-2 (EM 1110-345-290)	General Provisions and Geometric Design for Roads, Streets, Walks, and Open Storage Areas.
TM 5-822-5 (EM 1110-345-291)	Flexible Pavement Design for Roads, Streets, Walks, and Open Storage Areas.
TM 5-822-6 (EM 1110-345-292)	Rigid Pavement Design for Roads, Streets, Walks, and Open Storage Areas.
TM 5-823-2 (EM 1110-3-312)	Army Airfield-Heliport Flexible Pavement Design.
TM 5-823-3 (EM 1110-3-313)	Army Airfield-Heliport Rigid and Overlay Pavement.

TM 5-823-4 (EM 1110-3-314)	Army Airfield-Heliport Operational and Maintenance Facilities.
TM 5-824-1 (EM 1110-345-301)	General Provisions for Airfield Design.
TM 5-824-2 (EM 1110-45-302)	Air Force Flexible Airfield Pavements.
TM 5-824-3 (EM 1110-45-303)	Air Force Rigid Airfield Pavements.
TM 5-826-1 (EM 1110-3-761)	Army Airfield-Heliport Pavement Evaluation Concepts.
TM 5-826-2 (EM 1110-3-762)	Army Airfield Flexible-Pavement Evaluation.
TM 5-826-3 (EM 1110-3-763)	Army Airfield-Heliport Rigid Pavement Evaluation.
TM 5-826-4 (EM 1110-3-764)	Army Airfield-Heliport Pavement Reports.
TM 5-852-7 (EM 1110-345-376)	Surface Drainage Design for Airfields in Arctic and Sub-Arctic Regions.

3. DEFINITIONS. Definitions of general terms and paved areas used in this manual are given below:

Airfield. A group of facilities designed for takeoff, landing, servicing, fueling, and parking of fixed-wing and rotary-wing aircraft.

Heliport. A group of facilities designed for takeoff, landing, servicing, fueling, and parking of rotary-wing aircraft.

Helicopter landing pad. A prepared area on the ground designated and used only to accommodate takeoff and landing of helicopters at facilities such as hospitals, depots, or remote military installations.

Landing area. A cleared, leveled area typically comprised of a runway or landing pad and its abutting shoulders and cleared areas prepared to provide safe operations for aircraft landings and takeoffs.

Hover. The action of the helicopter, with aid of the ground cushion, to maintain altitude while holding a constant heading, without forward motion, over a selected point on the ground or slowly moving along a prescribed unobstructed route, such as a hoverlane.

Hoverpoint. An area designated and marked on the ground to which skid-mounted helicopters will be hovered prior to departure and on return, before proceeding to a parking space. Landings are not made at hoverpoints and the helicopter remains airborne at hover until cleared to park or depart.

Hoverlane. An aerial taxilane provided for hovering skid-mounted helicopters between the hoverpoint and assigned parking area.

Taxilane. An aircraft traffic lane through or on the edges of parking, maintenance, and hangar access aprons to permit ground movement of aircraft.

Taxiway strip. A cleared, leveled area typically comprised of a taxiway and its abutting shoulders and cleared areas prepared to provide safe conditions for ground movement of aircraft between runways and aircraft-parking or maintenance areas.

Engine runup apron. A paved area adjacent to a taxiway near the end of a runway where aircraft normally perform the final portion of warmup or engine and instrument checks to assure proper engine performance prior to takeoff.

Mass parking aprons. Paved areas required for parking, loading, unloading, maneuvering, and servicing aircraft.

Hangar access aprons. Paved areas connecting the hangar aircraft entrances with adjacent aircraft parking areas and hardstand areas.

Dispersed hardstand areas. Areas provided for parking transport helicopters when operating under their own power.

Aircraft washing areas. Paved and drained areas e
the necessary appurtenances for washing and cleaning aircra

Subgrade. The natural soil in place, or fill material
pavement, base, or subbase course is constructed.

Compacted subgrade. The upper part of the subgrade
compacted to a density greater than that of a portion of the su
below.

Base or subbase courses or combined courses. Natur
or processed materials placed on the subgrade beneath the pav

Pavement. A surface of prepared or manufactured prc
imposed on the base or subgrade either as a structural membe
weather- and abrasive-resisting medium.

Overlay pavement. Pavement superimposed on existing
or on existing pavement and base to reinforce the load-carrying

4. PLANNING, DESIGN, AND SELECTION OF PAVEMENTS
ARMY AIRFIELDS AND HELIPORTS. a. Planning. Each c
pavement planned for aircraft traffic as described below will be
for the corresponding loading as follows:

Class	Planned Aircraft Traffic	Loading
SM	Skid-mounted helicopters only	Class F road based on Group gory III traffic having a desig of 2. (See TM's 5-822-5 and
AA	Army aircraft only, wheel-mounted	15,000-lb. load on twin wheels 20 in. c-c, 100-sq.-in. contact each wheel.
LC	Light cargo (C-47, C-123, etc.) in addition to Army aircraft	25,000-lb. load on single-wheel with 100-p.s.i. tire pressure
HC	Medium-heavy cargo (C-124, C-130, etc.)	Gear load of critical planned aircraft.

b. Design. The following paved areas for aircraft will be designed for rigid pavement only:

(1) Parking, maintenance, and access aprons.

(2) Hardstands (taxilanes and taxiways not included).

(3) Aircraft washing areas.

(4) Compass swinging bases (taxiway not included).

(5) Hangar floors.

All other pavements subject to aircraft traffic will be designed for both rigid and flexible pavements. Selection of pavement type to be constructed will be based on least first cost.

c. Selection. Where rigid pavement is to be constructed, the minimum thickness of the portland-cement concrete will be 6 inches. Where flexible pavement is to be constructed, the asphaltic concrete mix design will be based on current high-pressure tire (75 blow) criteria.

d. Exceptions. Exceptions to design loadings and pavement type are as follows:

(1) Special consideration will be given to design of pavements for primary training, missile support, and other special mission airfields and heliports, and helicopter landing pads. Pavements for these special use installations will be designed to support the planned operations of the more critical using aircraft. When this results in a design load of less than 10,000 pounds on a single-wheel gear, 100-p.s.i. tire pressure, the proposed design will be forwarded to the Chief of Engineers, ATTN: ENGMC-ER, for approval.

(2) Where reduced operational requirements warrant consideration of least cost pavement in hardstand and apron areas, justification will be forwarded to the Chief of Engineers, ATTN: ENGMC-ER, for approval.

5. CRITERIA FOR PLANNING ARMY AIRFIELDS AND HELIPORTS AND FOR AIRSPACE AND CLEARANCES. a. Dimensional and other

requirements specified in appendixes I through VI, inclusive, apply.

b. Requests for exceptions to these criteria, in conjunction with master plan submissions and where a project design directive will be affected, will be submitted with appropriate justification by the District Engineer through channels to the Chief of Engineers, ATTN: ENGMC-EP, with an information copy to the using service.

c. Criteria contained in the regulations and manuals listed in paragraph 2 will be complied with except as follows:

(1) Exceptions shown on the general site plan of the installation and approved by the Chief of Engineers for the Department of the Army.

(2) Exceptions contained in a project design directive issued by the Chief of Engineers.

APPENDIX I

CRITERIA FOR PERMANENT ARMY AIRFIELDS

AIRFIELD RUNWAYS

No.	Description	Dimensional or Other Requirements	Remarks
1	Length	3,000 ft. m.s.l.	An increase of 10% for each 1,000 ft. in altitude above 2,000 ft. will be made. A temperature correction of 4% will be added for each 10° F. increase above 59° F. in mean temperature for warmest period during which operations will be conducted.
2	Width	75 ft.	Unless otherwise specified.
3	Shoulder width	25 ft.	Shoulders (nonpaved) will be provided adjacent to longitudinal edges of runways. They will not be normal aircraft or vehicular traffic areas and are intended only to minimize the probability of serious damage to aircraft using these areas accidentally or in cases of emergency. Shoulders will be surfaced with soils selected for stability in wet weather, and thoroughly compacted. Dust and erosion control will be provided by vegetative cover, coarse-graded aggregate, or liquid palliatives. (See fig. I-2.)

4	Clearance from runway centerline to fixed and/or movable obstacles	500 ft. (instrument and noninstrument) 125 ft. (limited use)	Fixed obstacles include buildings, trees, rocks, terrain irregularities, and any other feature constituting a possible hazard to moving aircraft. Movable obstacles include moving and parked aircraft, vehicles, railroad cars, etc. The prescribed clearances apply with equal force to aprons, parallel taxiways, roads, highways, and railroad tracks. Helicopter landing areas, landing pads, and hoverpoints are permitted to be constructed 300 ft. or more from runway centerline. (See fig. I-1.)
5	Longitudinal grades of runways and shoulders	Maximum 1.0%	Grading requirements are dictated by the operational limitations of aircraft, the need for adequate surface drainage, and the necessity for exercising economy measures in the development of an airfield site. Consistent with these factors and because runway lengths are computed on the basis of generally level pavements, longitudinal sloping of runways will be held to the minimum possible. The maximum rate of longitudinal grade change per 100 ft. of runway will not exceed 0.167% except for edges of runways and shoulders at runway intersections. This rate of change is produced by

No.	Description	Dimensional or Other Requirements	Remarks
		AIRFIELD RUNWAYS (Continued)	
			vertical curves having 600-ft. length for each percent of algebraic difference between the two grades. For more than one change in runway grade, the distance between two successive points of intersection will not be less than 1,000 ft. The maximum rate of longitudinal grade change per 100 ft. for edges of runways and shoulders at runway intersections will not exceed 0.4%. The transverse runway grade requirements are not mandatory at runway intersections. (See fig. I-2.)
6	Minimum sight distance	3,000 ft.	Any two points 5 ft. above pavements must be mutually visible for distance indicated.
7	Transverse grade of runways	Minimum 0.5% Maximum 1.5%	See fig. I-2.
8	Transverse grade of shoulders	Minimum 2.0% Maximum 3.0%	

9	Parallel runways (minimum clearance between centerlines of runways)	750 ft.	
10	Cleared areas, maximum slope	10%	Width of cleared areas depends on runway width. Lateral cleared areas are areas between runway shoulders and clearance lines limiting placement of building construction and other obstacles with respect to runway centerline. These areas (except where otherwise developed) will be rough-graded to the extent necessary to reduce damage to aircraft in event of erratic performance. (See fig. I-2.)
	AIRFIELD TAXIWAYS		
11	Width	40 ft.	
12	Shoulder	25 ft.	Shoulder treatment will be the same as that indicated in item 3. (See fig. I-2.)
13	Clearance from taxiway edge to fixed and/or movable obstacle	125 ft.	For definition of fixed and movable obstacles see remarks, item 4. Where mass apron abuts a continuation of a parallel or lateral taxiway a minimum clearance of 80 ft. will be provided from the perimeter taxiway

	horizontal curves, minimum radius to near edge of taxiway		Curved taxiways are normally located where parallel taxiways to runways intersect connecting taxiway at ends of runways. (See fig. I-2.)
19	Fillet of pavement junction, minimum radius	25 ft.	
	AIRFIELD APRONS		
20	Fillet of pavement junction, minimum radius	25 ft.	
21	Apron shoulder width	25 ft.	Shoulders will be provided along permanent edges unless otherwise specified. (See fig. I-1.) Same remarks as for item 3.
22	Transverse grade of apron shoulder	Minimum 2% Maximum 3%	Shoulders will slope away from apron.
23	Lateral clearance from rear and sides of aprons to fixed and/or movable obstacles	75 ft.	For definition of fixed and movable obstacles see remarks, item 4, and fig. I-1.
24	Grade (any direction)	Minimum 0.5% Maximum 1.5%	Pavement gradients exceeding minimum specified are intended for those areas where design of expansive

...l No.	Description	Dimensional or Other Requirements	Remarks
		AIRFIELD APRONS (Continued)	
			pavements to accommodate unusual runoff dictates such a requirement. Economic factors imposed by difficult terrain features may also require steeper gradients. Arbitrary use of gradients in excess of actual or reasonable requirements is not within the intent herein. For example, in designing so-called "sawtooth" surface drainage patterns, extreme care must be exercised to prevent the use of steep grades or rapid grade changes at relatively short intervals. Such surface irregularities aggravate normal flexing of aircraft blades while taxiing and may result in damage to low underslung appurtenances on the aircraft.
25	Area required for mass parking apron	Determine in accordance with appendix IV	Unless otherwise specified.
		AIRFIELD ENGINE RUNUP AND HOLDING APRONS	
26	Length	100 ft.	See fig. I-1.
27	Width	150 ft.	See fig. I-1.

AIRFIELDS, LIMITED USE

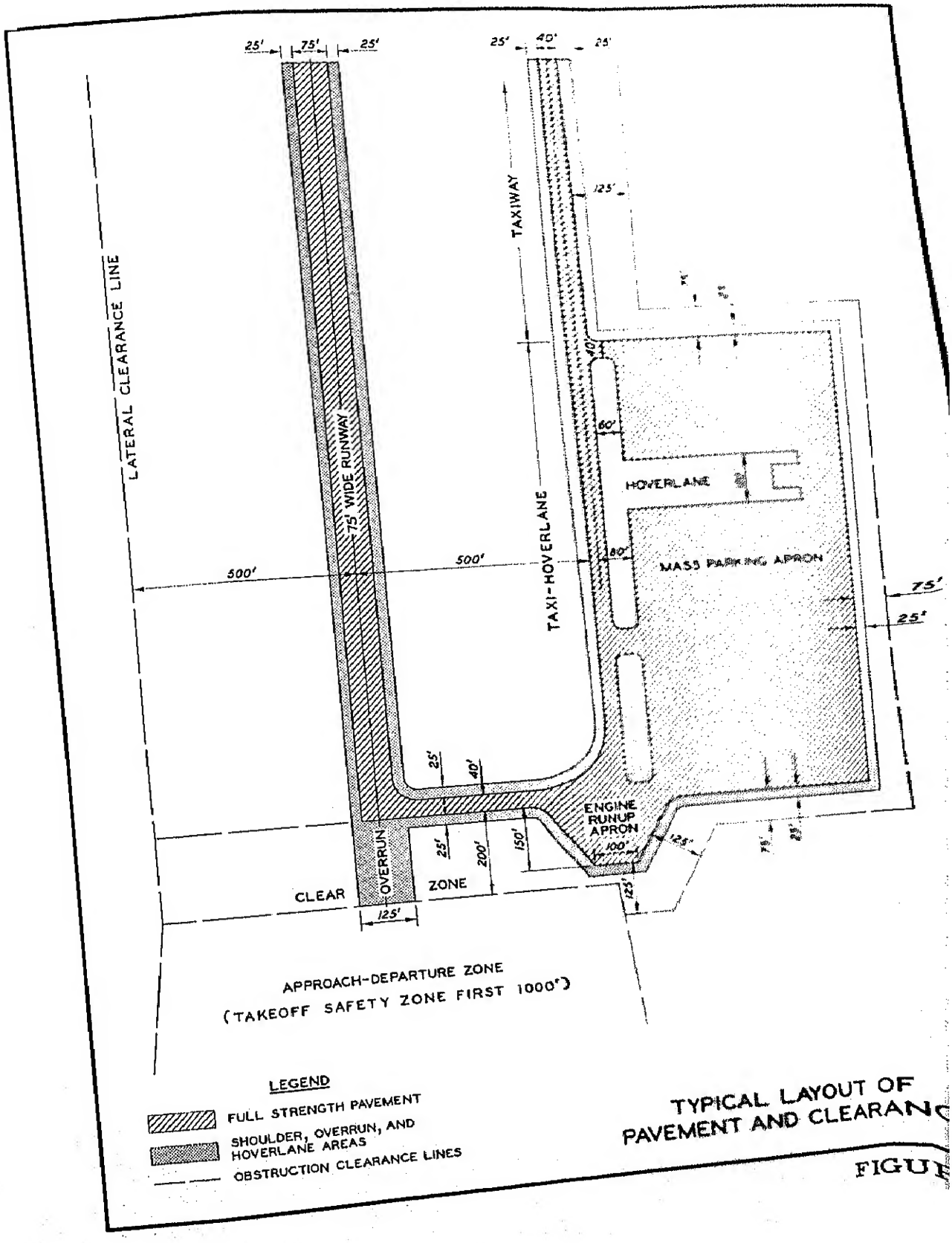
44	Approach-departure surface ratio	1:20	
45	Length	10,000 ft.	
46	Widths		
	At end of clear zone	250 ft.	
	At outer end	2,250 ft.	

AIRFIELD TAKEOFF SAFETY ZONE

47	Length	1,000 ft.	Area at takeoff end of each approach-departure zone under control of the command and free of obstructions, provided as an emergency-landing area in event of engine failure. (See fig. I-3.)

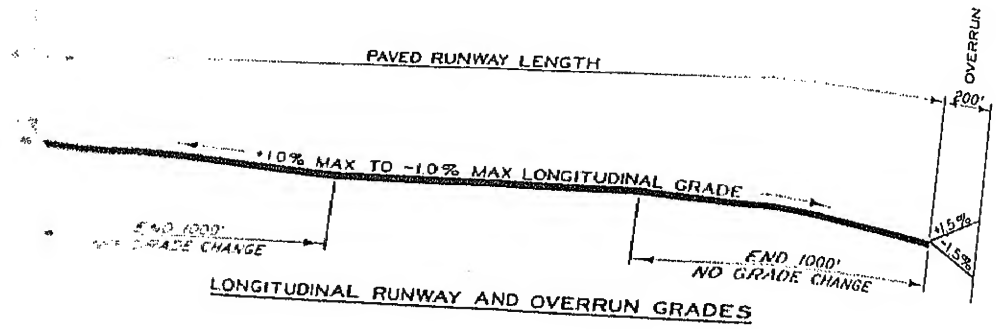
AIRFIELD TRANSITIONAL SURFACE

48	Slope	1:7	Hedge planting, fences, and other fixed or movable obstacles and/or structures will not exceed the transitional surface.

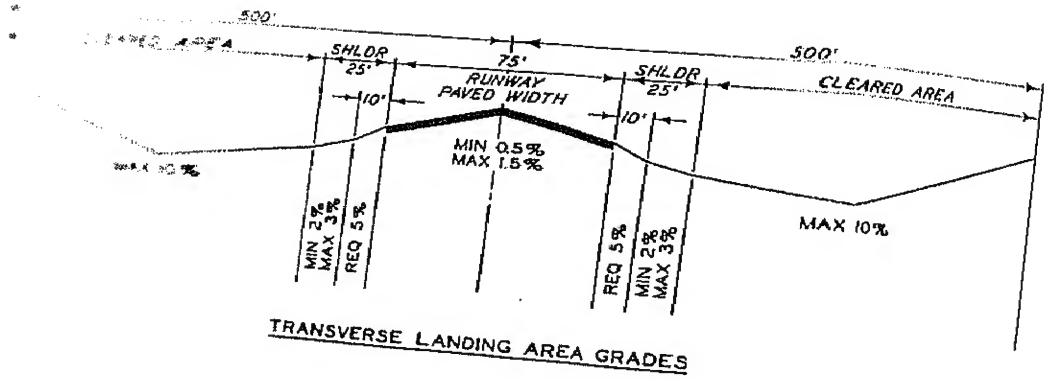


TYPICAL LAYOUT OF PAVEMENT AND CLEARANC

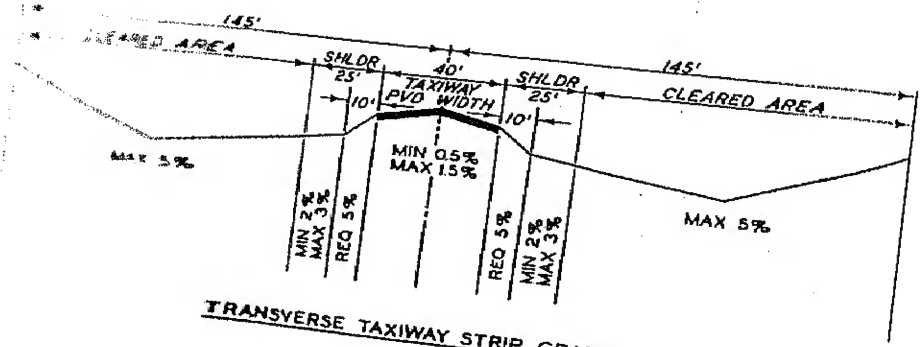
FIGU



LONGITUDINAL RUNWAY AND OVERRUN GRADES



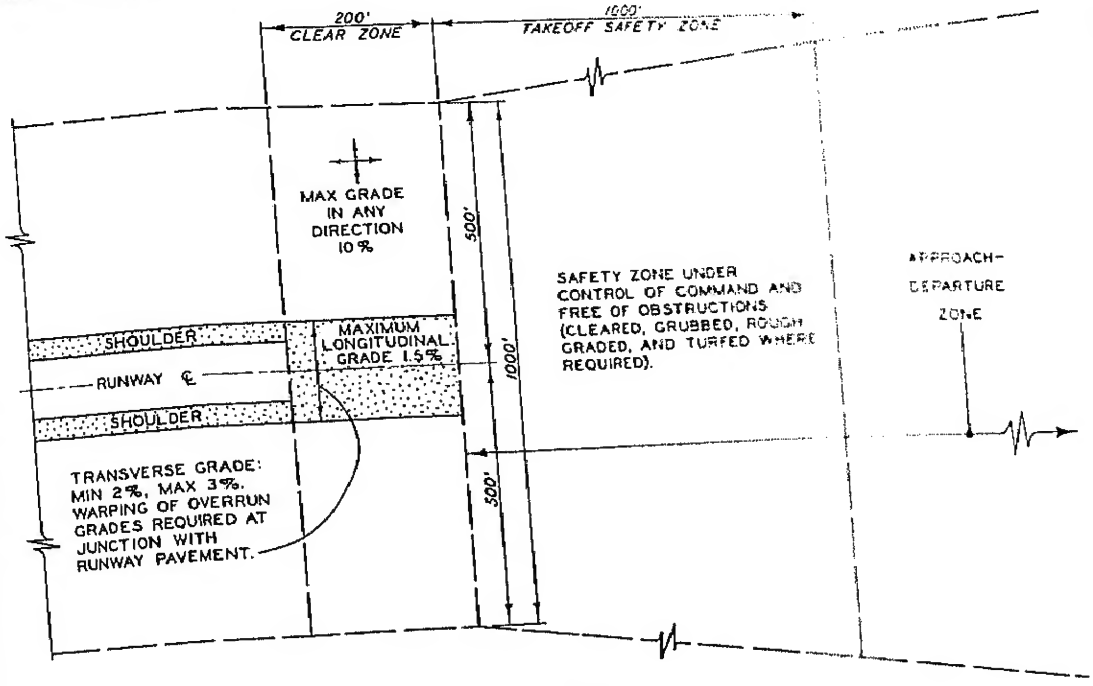
TRANSVERSE LANDING AREA GRADES



TRANSVERSE TAXIWAY STRIP GRADES

FIGURE 1-2

RUNWAY, TAXIWAY, AND OVERRUN GRADES



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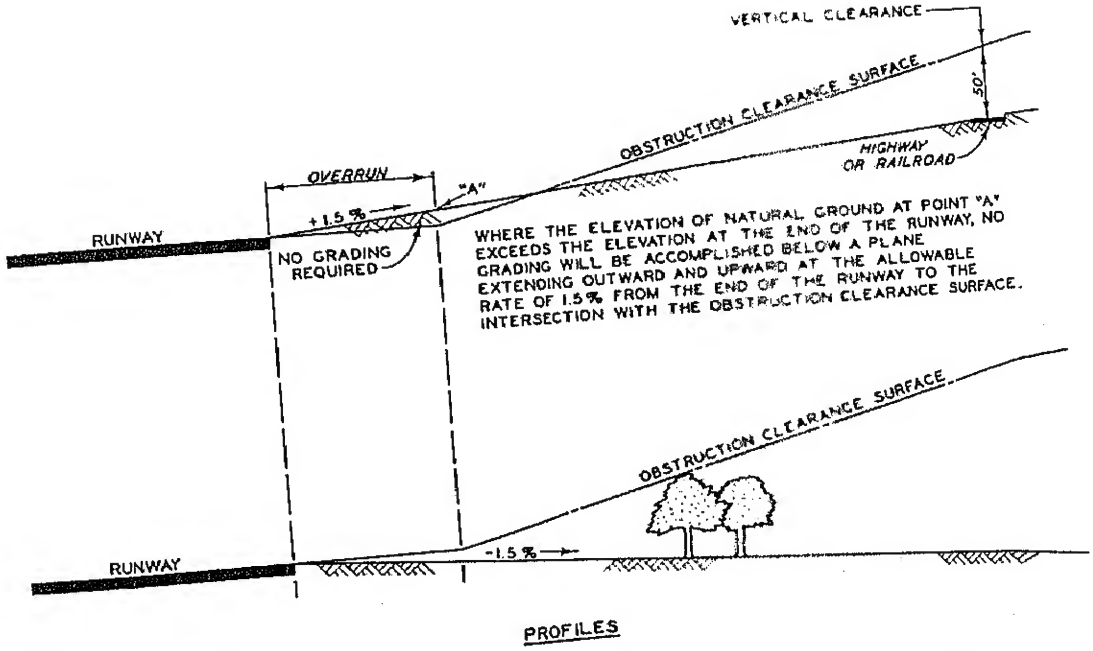


PROFILES

END PORTION OF LANDING ARE REQUIREMENTS

APPENDIX II

CRITERIA FOR PERMANENT ARMY [illegible]

2	Width	75 ft.	Unless otherwise specified.
3	Longitudinal grades of runways and shoulders	Maximum 1.0%	Grading requirements are dictated by the operational limitations of the aircraft, the need for adequate surface drainage, and the necessity for exercising economy measures in the development of a heliport site. Consistent with these factors and because the runway lengths are computed on the basis of generally level pavements, longitudinal sloping of runways will be held to the minimum possible. Grades of edges of runways and shoulders of runway and taxiway intersections will be held to a minimum.

4	Transverse grade of runway	Minimum 0.5% Maximum 1.5%	Not mandatory at runway intersections.
5	Shoulder width	25 ft.	These areas are provided for emergency use of aircraft and for dust and erosion control. Shoulder areas will be compacted to a minimum of 90% of CE 55 maximum density as determined by Military Standard MIL-STD-621(CE), test method S1. Stabilization for dust and erosion control will be adequate for prevention of displacement of shoulder materials by blast of rotor blades. Vegetative cover, coarse-graded aggregate, liquid palliatives, or a double bituminous surface treatment may be used. A base course 4 in. thick of CBR 40+ material will be used when double bituminous surface treatment is specified.
6	Transverse grade of shoulders	Minimum 2.0% Maximum 3.0%	Shoulders will slope away from runway.
7	Clearance from runway centerline to fixed and/or movable obstacles	125 ft.	Fixed obstacles include buildings, trees, rocks, terrain irregularities, and any other feature constituting a possible hazard to moving aircraft. Movable obstacles include moving and parked aircraft, vehicles, railroad cars, etc. The prescribed clearances apply with equal force to

Item No.	Description	Dimensional or Other Requirements	Remarks
	HELIPORT RUNWAYS (Continued)		
			aprons, hardstands, parallel taxiways, roads, highways, railroad tracks, drainage headwalls, and drainage ditches.
8	Parallel runways (minimum clearance between centerlines of runways)	300 ft.	
9	Cleared areas, slope	Maximum 5.0%	Width of cleared areas depends on runway width involved. Lateral cleared areas are areas between runway shoulders and lateral clearance lines limiting placement of building construction and other obstacles with respect to runway centerline. These areas will be rough-graded to the extent necessary to reduce damage to aircraft in the event of erratic performance.
10	Minimum sight distances	450 ft.	Any two points 5 ft. above pavements must be mutually visible for distance indicated.

HELIPORT TAXIWAYS

11	Width	40 ft.	
12	Longitudinal grades of taxiways and shoulders	Maximum 2.0%	
13	Transverse grade of taxiway	Minimum 0.5% Maximum 1.5%	Same as remarks, item 5.
14	Shoulder width	25 ft.	Same as remarks, item 6.
15	Transverse grades of taxiway shoulders	Minimum 2.0% Maximum 3.0%	
16	Clearance from taxiway edge to fixed and/or movable obstacles	125 ft.	For definition of fixed and movable obstacles see remarks, item 7.
17	Grade in any direction in taxiway cleared area	Maximum 5.0%	Lateral cleared areas are areas between taxiway shoulders and clearance lines limiting placement of building construction and other obstacles with respect to taxiway shoulder edge. These areas will be rough-graded to the extent necessary to reduce damage to aircraft in event of erratic performance.

Item No.	Description	Dimensional or Other Requirements	Remarks
		HELIPORT HARDSTANDS AND APRONS	
18	Fillet of pavement junction, minimum radius	25 ft.	Fillets at hardstand entrances will be omitted.
19	Dimensions of dispersed hardstands Width Length	60 ft. 145 ft.	Medium transport helicopters (Chinook).
20	Mass parking aprons, dispersed hardstands, and access aprons	Mass parking apron requirements for reconnaissance, utility, or transport helicopter units of less than company size will be determined in accordance with requirements specified in fig. II-4; dispersed parking facilities will be in accordance with fig. II-3.	Unless otherwise specified.
21	Taxilane width, mass parking or maintenance apron	In interior, 140 ft.; near perimeter, 100 ft.	Medium transport helicopters (Chinook).
22	Taxi-hoverlane width	In interior, 120 ft.; near perimeter, 40 ft.	See fig. I-1, app. I.

23	Hardstand and apron shoulder width	Minimum 25 ft.	Same as remarks, item 5. Shoulders will be provided along permanent edges unless otherwise specified.
24	Hardstand and apron grade (in any direction)	Minimum 0.5% Maximum 1.5%	Pavement gradients exceeding minimum specified are intended for those areas where design of expensive pavement to accommodate unusual runoff dictates such a requirement. Economic factors imposed by difficult terrain features may also require the use of steeper gradients. Arbitrary use of gradients in excess of actual or reasonable requirements is not within the intent herein. For example, in designing so-called "sawtooth" surface drainage patterns, extreme care must be exercised to prevent use of steep grades or rapid grade changes at relatively short intervals. Such surface irregularities aggravate normal flexing of aircraft blades while taxiing and may result in damage to aircraft.
25	Transverse grade of shoulders for hardstand and apron	Minimum 2.0% Maximum 3.0%	Shoulder will slope away from pavement.

No.	Description	Dimensional or Other Requirements	Remarks
	HELIPORT HARDSTANDS AND APRONS (Continued)		
26	Lateral clearance from rear and sides of apron and hardstand areas to fixed and/or movable obstacles except to other aircraft pavements where 125 ft. clearance will be provided.	75 ft.	For definition of fixed and movable obstacles see remarks, item 7. Does not apply to sides of hardstands in dispersed parking area.
	HELIPORT ENGINE RUNUP AND HOLDING APRONS		
27	Length	Same as runway.	Must be justified by operational requirements. Will not be provided where engine runups can be performed on hardstands.
28	Width	150 ft.	
29	Grades in any direction	Minimum 0.5% Maximum 1.5%	
30	Shoulders	25 ft.	Same as remarks, item 5.
31	Transverse grade of shoulders	Minimum 2.0%	

		HELIPORT OVERRUN	
32	Length	Minimum 75 ft.	Design of overrun same as for runway shoulders in remarks, item 5.
33	Width	125 ft.	Width of runway plus shoulders.
34	Longitudinal grade	Maximum 1.0%	Overrun longitudinal grade should have the same grade as the runway.
35	Transverse grade	Minimum 2.0% Maximum 3.0%	
		HELIPORT CLEAR ZONE	
36	Length	75 ft.	
37	Width	250 ft.	
38	Grades outside of overrun and shoulders	Maximum 5.0%	
		HELIPORT APPROACH-DEPARTURE ZONE	
		Instrument and Noninstrument	
39	Approach-departure surface ratio	1:10	Approach-departure surface ratio from outer end of clear zone.

40	Length	1,500 ft.	Approach-departure zones and surfaces will be extended at a width, of 850 ft., where required in order to reach helicopter operating levels above 150 ft.
41	Widths At end of clear zone At outer end	 250 ft. 850 ft.	

HELIPORT TAKEOFF SAFETY ZONE

42	Length	1,000 ft.	Area at takeoff end of each approach zone under control of the command and free of obstacles, provided as an emergency-landing area in event of engine failure.
	Width	Same as approach-departure zone	

HELIPORT TRANSITIONAL SURFACE

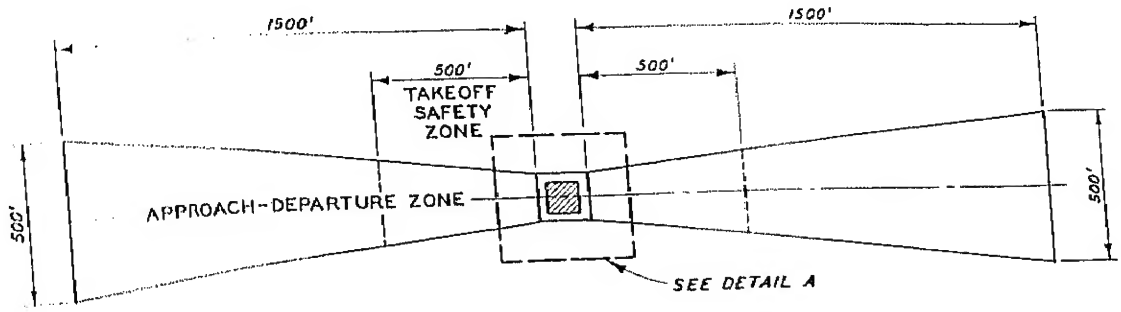
43	Slope	1:2	Hedge, planting, fences, and other fixed or movable obstacles and structures will not extend abov[illegible]

APPENDIX III

CRITERIA FOR PERMANENT ARMY HELICOPTER LANDING PAD

			bituminous surface treatment is specified.
5	Longitudinal grade of shoulder	Same as landing pad	
6	Transverse grade of shoulder	Minimum 2.0% Maximum 3.0%	Shoulders will slope away from the landing pad.
	LANDING AREA (See fig. III-1)		
7	Length	120 ft. skid-mounted 150 ft. wheel-mounted	
8	Width	120 ft. skid-mounted 150 ft. wheel-mounted	
9	Grades outside of shoulder area to limits of landing area	Maximum 3.0%	
	APPROACH-DEPARTURE ZONE (See fig. III-1)		
10	Approach-departure surface ratio	1:10	Surface ratio from outer end of landing area at same elevation of landing pad edge.
11	Length	1,500 ft.	Approach-departure zones and obstruction-clearance surfaces will be extended, at a width of 500 ft., where required in order to reach helicopter operating levels above 150 ft.

No.	Description	Dimensional or Other Requirements	Remarks
		APPROACH-DEPARTURE ZONE (Continued)	
12	Widths At end of landing area At outer end	 Same as landing area 500 ft.	
		TRANSITIONAL SURFACE (See fig. III-1)	
13	Slope	1:2	Hedge, planting, fences, and other fixed or movable obstacles and structures will not extend above transitional surfaces.
		TAKEOFF SAFETY ZONE (See fig. III-1)	
14	Length Width	500 ft. Same as approach-departure zone	Area at takeoff end of each approach zone under control of the command and free of obstacles, provided as an emergency landing area in event of engine failure.
		HOVERPOINT (See fig. III-2)	
15	Circular domed to 6 in. at center	30-ft. diameter	For control of skid-mounted helicopters only. Requires same areas as set forth in preceeding items 10, 11, 12, and 13.
16	Clear area Length Width	 120 ft. 120 ft.	For skid-mounted helicopters only.



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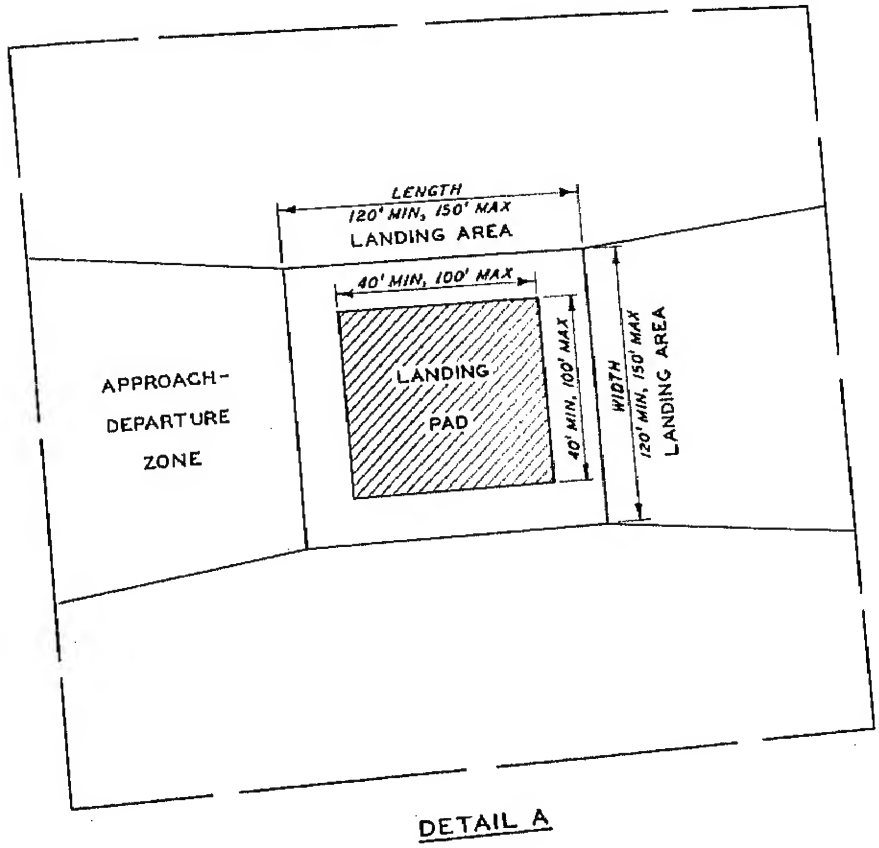
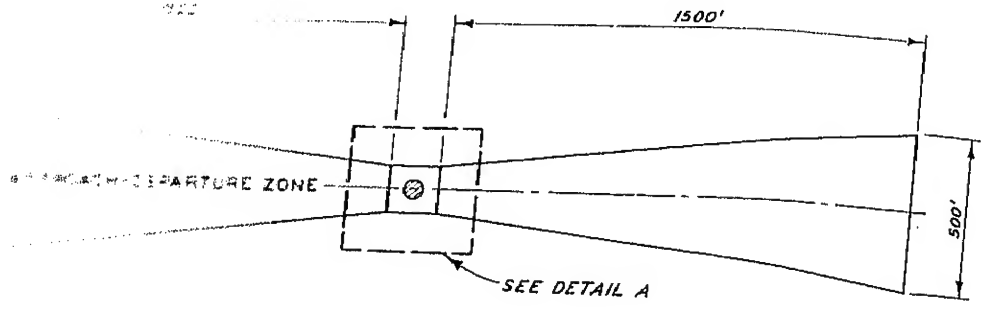


DETAIL A

TYPICAL LAYOUT OF
HELICOPTER LANDING P

FIGURE



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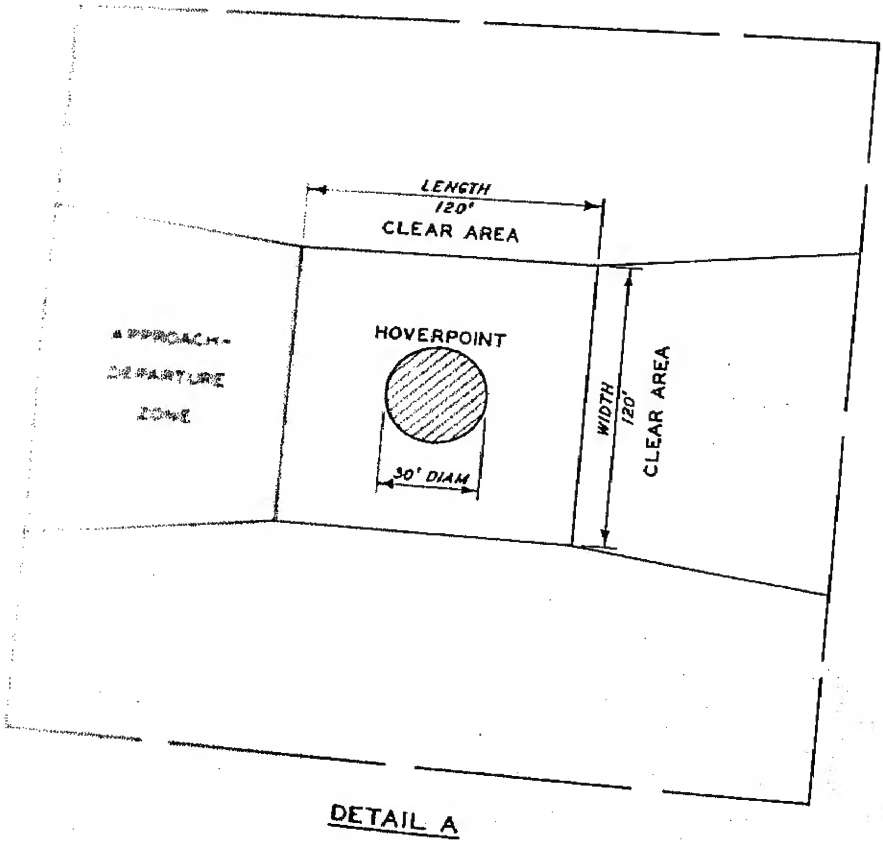


DETAIL A

FIGURE III-2

TYPICAL LAYOUT OF
HELICOPTER HOVERPOINT

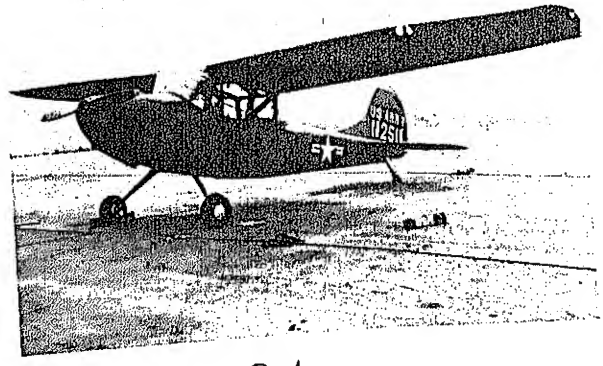
APPENDIX IV

CRITERIA FOR MASS PARKING APRONS

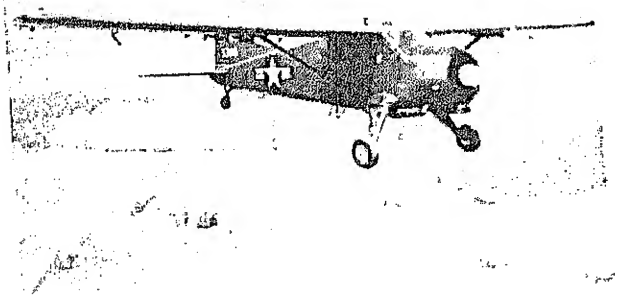
	Description	Dimensional or Other Requirements	Remarks
	TAXILANES-HOVER LANES		
		Interior	
1	Fixed-wing aircraft except Caribou, width	80 ft.	See tables IV-1 and IV-2.
2	For Caribou, width	120 ft.	
3	All aircraft (fixed-wing and rotary-wing), width	160 ft.	Principal taxilanes only. Least-first-cost paving.
		Perimeter	
4	Fixed-wing aircraft except Caribou, width	60 ft.	
5	For Caribou, width	80 ft.	
6	All aircraft (fixed-wing and rotary-wing), width	100 ft.	Principal taxilanes only. Least-first-cost paving.

	SERVICE LANES		
7	Rotary-wing, wheel-type, interior, width	30 ft.	Between rows of parking spaces.
8	Rotary-wing, skid-type, connecting, width	12 ft.	Centered on common line of abutting parking spaces.
	PARKING LANES		
9	Fixed-wing except Caribou, width	40 ft.	
10	For Caribou, width	80 ft.	
11	Fixed-wing, length	Wing span plus 5 ft. times number of aircraft less 5 ft.	Or 50 ft. per aircraft except Caribou.
	PARKING SPACE		
12	Skid-type helicopter: Power Manual	80 × 80 ft. 16 or 20 × 60 ft.	20-ft.-wide rigid paving strip 20 ft. from hoverlane (for skid-mounted helicopters only).
13	Wheel-mounted helicopter	100 × 100 ft.	60-ft.-wide rigid paving strip 20 ft. from hoverlane.

14	Skid-type helicopter, width	120 ft	
		SPECIAL APRONS	
15	Skid-type helicopters, width	120 ft.	Provides double row of parking (with service lane) adjacent to hoverlanes.
16	Wheel-mounted helicopters, length	160 ft. times number of aircraft, plus 20 ft.	Provides parking for twice as many skid-type helicopters, less one, under own power.
17	Wheel-mounted helicopters, width	390 ft.	With length as per item 16, provides for either double row of wheel-mounted helicopters or 4 rows of skid-type helicopters. Center 160 ft. of apron will be least-first-cost type of pavement. Where justified only.

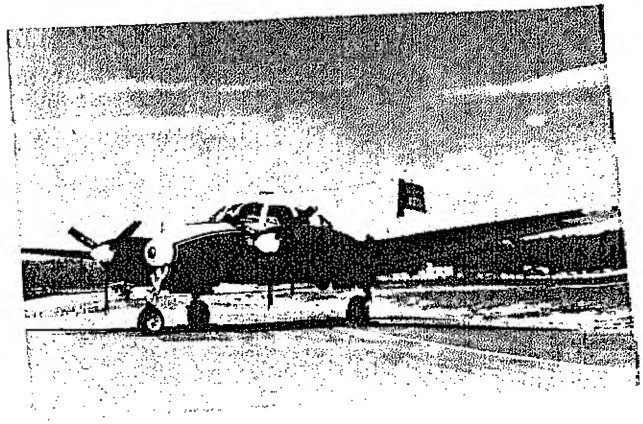


O-1
Birddog

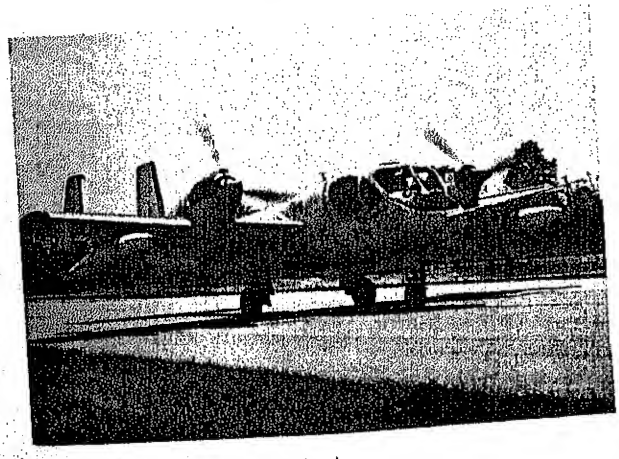


U-6
Beaver

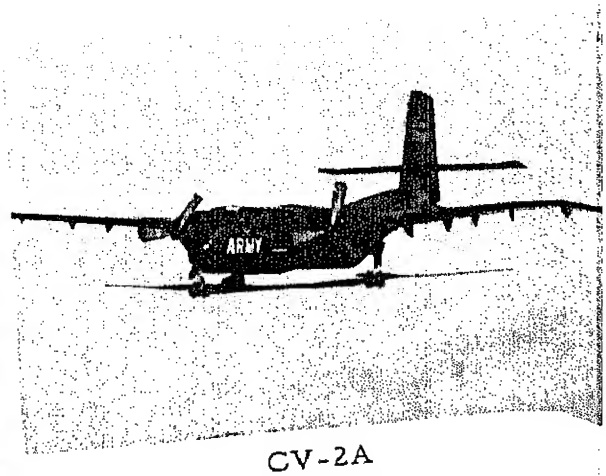
U-1A
Otter



U-8
Seminole

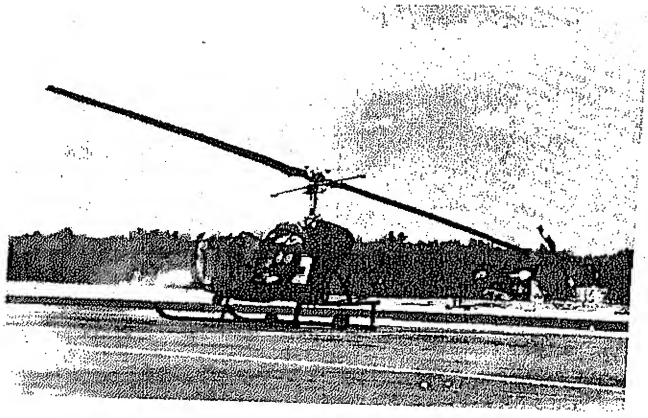


OV-1
Mohawk

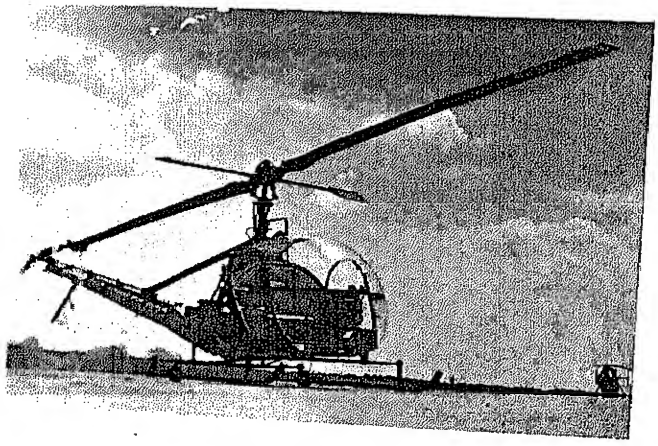


CV-2A
Caribou

ARMY FIXED-WING AIRCRAFT FIGURE IV



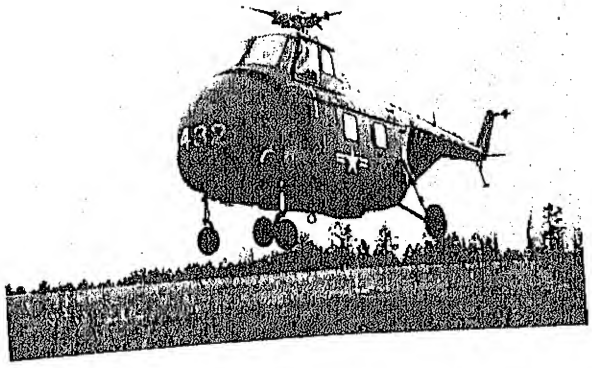
OH-13
Sioux



OH-23
Raven

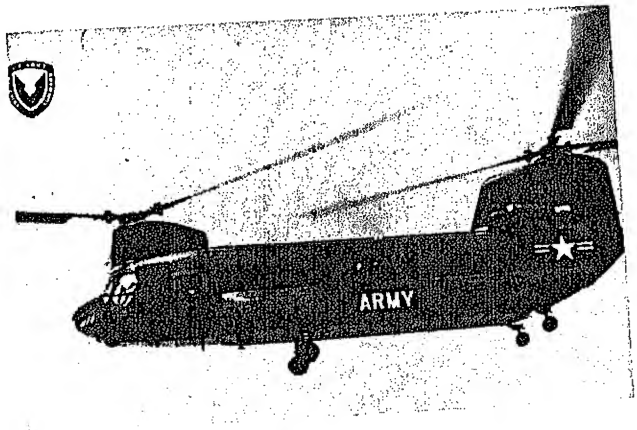
UH-1
Iroquois

AIRCRAFT, SKID-MOUNTED

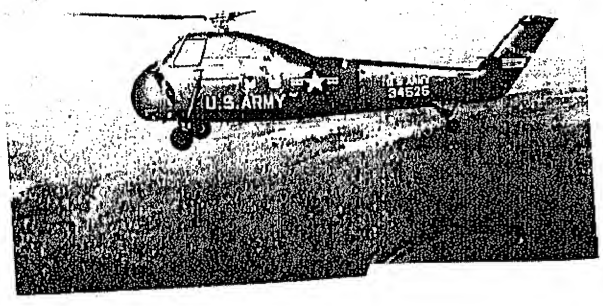


UH-19
Chickasaw

CH-21
Shawnee



CH-47
Chinook



CH-34
Choctaw

ARMY ROT.

Table IV-1

CHARACTERISTICS OF ARMY AIRCRAFT

Aircraft Description					Overall Dimensions ft			Tread in.	Wheel Base in.	Weight, lb		Gear Type‡	Design Gear Load lb	Twin Wheel Spacing in.	Main Gear Tires				Takeoff (Hard Surface) Sea Level, 0-Wind, ft.		Fuel Grade	Fuel Capacity gal.
Current Desig.	Former Desig.	Name	Manufacturer	Type†	Length	Width	Height			Basic	Maximum Takeoff				Size	Type	P.S.I.	Cont. Area sq. in.	Ground Run	Clear 50 ft.		
										FIXED-WING												
O-1E	L-19E	Birddog	Cessna	O	25.8	36.0	9.2	90.0	236	1,618	2,400	A	1,150	--	7.00x6	III	21	52	390	675	{115 145	41
OV-1A	AO-1A	Mohawk	Grumman	O	41.0	42.0	12.6	110.0	139	9,678	14,345	B	6,097	--	8.50x10	III	85	70	1,300	2,050	JP-4	597
OV-1B	AO-1B	Mohawk	Grumman	O	43.8	48.0	12.6	110.0	139	10,655	15,381	B	6,537	--	8.50x10	III	93	70	1,580	2,390	JP-4	597
OV-1C	AO-1C	Mohawk	Grumman	O	41.0	42.0	12.6	110.0	139	10,009	14,678	B	6,237	--	8.50x10	III	89	70	1,580	2,390	JP-4	597
AV-1D	AO-1D	Mohawk	Grumman	A	41.0	42.0	12.6	110.0	139	9,860	17,033	B	7,239	--	8.50x10	III	103	70	Undetermined		JP-4	597
CV-2	AC-1	Caribou	DeHavilland	C	72.6	95.6	31.8	277.5	263	18,605	28,500	E		20	11.00x12	III	39	150	725	1,185	{115 145	828
CV-7	AC-2	Caribou	DeHavilland	U	77.3	96.0	28.7	366.0		22,550	{34,000S 38,000C	E							625	1,000	JP-4	
UI-A	UI-A	Otter	DeHavilland	U	41.8	58.0	12.4	134.4	334	4,758	8,000	A	3,000		11.00x12	III	28	102	1,045	1,605	{115 145	213
U-6A	L-20A	Beaver	DeHavilland	U	30.5	48.0	10.4	122.0	273	3,370	5,100	A	2,500		8.50x10		25	94	815	1,220	{115 145	138
U-8D	L-23D	Seminole	Beech	U	31.5	45.3	11.3	153.6	129	4,978	7,000	B	3,024		8.50x10	III	35	73	1,265§	2,155	{115 145	230
U-8F	L-23F	Seminole	Beech	U	33.3	45.9	14.3	141.6		5,282	7,700	B							1,320§	2,200	{115 145	230
										ROTARY-WING												
OH-13G&H	H-13G&H	Sioux	Bell	O	41.4	35.1	{9.4G 9.5H	90.0	115.0	{1,534G 1,814H	{2,350G 2,750H	Skid	{1,175G 1,375H	--	Skid	--	--	--	0	{305G 355H	{115 145	41
OH-23B	H-23B	Raven	Hiller	O	40.5	35.0	9.8	90.0	109#	1,761	2,500	Skid	1,250		Skid	--	--	--	0	210	{115 145	28
OH-23D	H-23D	Raven	Hiller	O	40.7	35.4	10.1	90.0	109#	1,781	2,700	Skid	1,350		Skid	--	--	--	0	210	{115 145	46
AH-1	HU-1	Iroquois	Bell	A/U	53.0	44.0	14.6	114.0	129.9	{Util 4,487 Att 4,662	{Util 8,500 Att 8,600	Skid	{Util 4,250 Att 4,300	--	Skid	--	--	--	0	0	JP-4	290
UH-19C	H-19C	Chickasaw	Sikorsky	U	62.4	53.0	14.5	132.0	126.0	4,995	8,100	M			6.50x10	II	57	77	185#	555	{91 96	168
UH-19D	H-19D	Chickasaw	Sikorsky	U	62.3	53.0	15.3	132.0	126.0	5,750	8,564	M							285	605	{91 96	163
CH-21C	H-21C	Shawnee	Vertol	C	86.3	44.0	15.4	172.3	295.8A	9,148	15,200	B	6,540		24.00x7.7		115	53	0	510	{115 145	630
CH-34	H-34	Choctaw	Sikorsky	C	65.8	56.0	15.9	144.0	339.0	7,732	13,000	A							0	0	{115 145	262
CH-37	H-37	Mojave	Sikorsky	C	88.0	72.0	22.0	237.6	432.0	21,017	31,000	Aa	14,000	16					170	390	{115 145	1,000
CH-47A	HC-1B	Chinook	Vertol	C	98.3	59.2	18.5	143.0	266.4	16,973	33,000	N	{12,255F 5,660R	13F	{22.00x5.5F 16.00x4.4R		{138F 165R	{45F 17R	0	0	JP-4	630

Note: Basic Data Source, Standard Aircraft Characteristics, vol. II, "Brown Book," USAF.

† Aircraft type identification:
O - observation
A - attack
C - cargo/transport
U - utility

‡ Gear type identification:
A - Single, conventional — main gear / tail gear
B - Single, tricycle — single nose gear / single main gear
E - Twin, tricycle — twin nose gear / twin main gear
M - Single, quad — forward gear / rear gear
N - Twin, quad — forward gear / rear gear

§ Ground roll 1,185
¶ Ground roll 1,310
# Ground roll 290

Twin, conventional ... twin main gear / tail gear

APPENDIX V

CRITERIA FOR DETERMINING OBSTRUCTIONS TO AIR NAVIGATION AT ARMY AIRFIELDS

1. GENERAL. Any natural object or manmade structure that protrudes above the planes or surfaces defined below or that exceeds the limiting heights aboveground described in paragraph 3 is considered an obstruction to air navigation.

2. DEFINITIONS. Figure V-1 illustrates the following definitions. If conflict exists between the definition and the illustration, the definition will govern.

a. Army Airfield. An area on the ground designated and used to accommodate takeoff, landing, servicing, and parking of Army aircraft.

b. Established Airfield Elevation. The elevation, in feet above mean sea level, of the highest point on the landing area that is used or intended to be used for takeoff and landing operations.

c. Landing Area. A specially prepared surface within the boundaries of an airfield designed for aircraft takeoff and landing operations. It includes the paved runway surface and shoulder and the cleared areas immediately adjacent thereto that have been cleared of all aboveground obstructions. In no case will the width of the landing area be less than the width of the approach-departure zone at the end of the runway. The width of the landing area for a fixed-wing-aircraft runway normally is 1,000 feet (minimum of 250 feet for a limited-use runway). The length of the landing area is the same as the runway length.

the elevation for the beginning of the transitional surface at any point along the lateral boundary of the landing area and the clear zone, draw a line from the point perpendicular to the runway centerline. The elevation at the runway centerline is the elevation for the beginning of the 1:7 slope.

k. Inner Horizontal Surface. This is an imaginary level plane, oval in shape, located 150 feet above the established airfield elevation. It is constructed by scribing an arc with a radius of 7,500 feet about the centerline at the end of all runways and connecting these arcs with tangents. (See fig. V-1.)

l. Inner Conical Surface. An imaginary inclined surface extending upward and outward, at a slope ratio of 1:20, from the periphery of the inner horizontal surface for a horizontal distance of 7,000 feet to a height of 500 feet above the established airfield elevation.

m. Outer Horizontal Surface. An imaginary, level plane located 500 feet above the established airfield elevation, extending outward from the periphery of the inner conical surface for 30,000 feet.

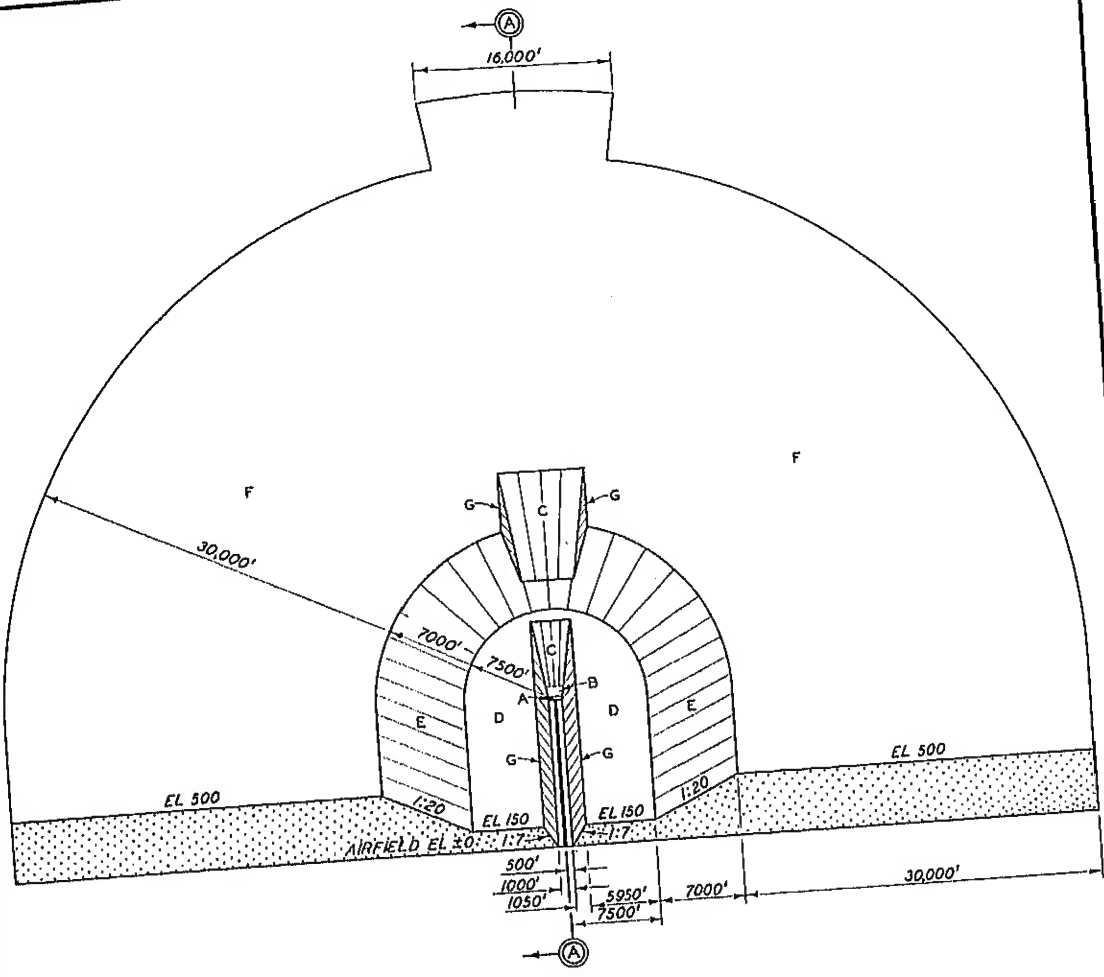
3. LIMITING HEIGHTS ABOVEGROUND. In addition to requirements set forth in paragraphs above, objects exceeding the limiting height aboveground described in this paragraph will be considered obstructions to air navigation but may be found not to be objectionable after special aeronautical study.

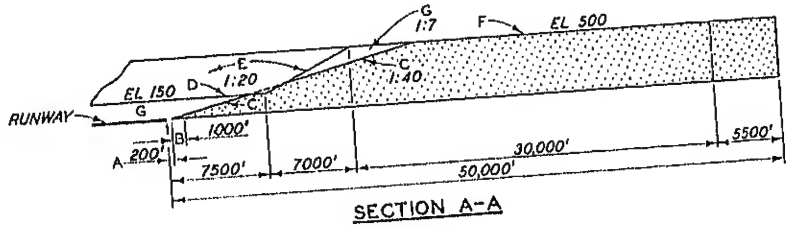
a. A height of 500 feet above the ground at the site of the structure.

b. A height of 200 feet above the ground at the site of the structure where it would be within the airfield control zone.

c. A height above the established airfield elevation which would require an increase in the final approach minimum flight altitude, where the object would be located within three statute miles of the geographical center of any airport on which a standard instrument approach procedure has been established or within two statute miles of the final approach course of a radio facility used for final letdown to the airport.

4. REMOVAL OF OBSTRUCTIONS. Natural and manmade objects determined to be obstructions to air navigation will be removed where





SECTION A-A

LEGEND

A	CLEAR ZONE
B	TAKEOFF SAFETY ZONE
C	APPROACH-DEPARTURE SURFACES (1:40)
D	INNER HORIZONTAL SURFACE
E	INNER CONICAL SURFACE (1:20)
F	OUTER HORIZONTAL SURFACE
G	TRANSITIONAL SURFACES (1:7)
	HORIZONTAL SURFACES
	SLOPING SURFACES
	CROSS SECTION OF AREA BELOW AIRSPACE CONTROL SURFACES

ISOMETRIC VIEW OF AIRFIELD-AIRSPACE CONTROL SURFACES

FIGURE V

APPENDIX VI

CRITERIA FOR DETERMINING OBSTRUCTIONS TO AIR NAVIGATION AT HELIPORTS AND LANDING PADS

1. GENERAL. Any natural or manmade structure that protrudes above the planes or surfaces defined below, or exceeds the limiting heights aboveground described in paragraph 3a below, is considered an obstruction to air navigation.

2. DEFINITIONS. Figure VI-1 illustrates the following definitions. If conflict exists between the definitions and the illustration, the definition will govern.

a. Army Heliport. An area on the ground designated and used to accommodate takeoff, landing, servicing, fueling, and parking of rotary-wing aircraft.

b. Established Heliport or Landing Pad Elevation. The elevation, in feet above mean sea level, of the highest point on the landing area that is used, or intended to be used, for takeoff and landing operations.

c. Heliport Landing Area. A specially prepared surface designed for rotary-wing-aircraft takeoff and landing operations. It includes the paved surface (runway or landing pad) and the areas immediately adjacent thereto that have been cleared of all aboveground obstructions. In no case will the width of the landing area be less than the width of the approach area at the end of the runway. Normally, the width of the landing area for a rotary-wing-aircraft runway is 250 feet. The length of the landing area is the same as the runway length. A landing area for skid-mounted helicopters is a 120- by 120-foot landing pad and for wheel-mounted helicopters a 150- by 150-foot landing pad.

d. Heliport Clear Zone. The areas immediately adjacent to the ends of a runway that have been cleared of all aboveground obstructions and graded to prevent damage to aircraft that land short or overrun the runway. The standard clear-zone dimensions are 75 feet long (measured along the extended runway centerline) and 250 feet wide (125 feet on each side of the extended runway centerline), see figure VI-1.

horizontal surface and in some instances to the inner- and outer-conical surfaces of the airfield. (See figs. VI-1 and VI-2.) The slope of the transitional surface is 1:2 upward and outward, measured at right angles to the axis of the runway. To determine the elevation for the beginning of the transitional surface slope at any point along the lateral boundary of the landing area including the clear zone, draw a line from the point perpendicular to the runway or landing pad centerline. The elevation at the runway centerline is the elevation for the beginning of the 1:2 transitional slope.

3. LIMITING HEIGHT ABOVEGROUND IN HELIPORT AREAS. In addition to requirements set forth in paragraphs above, objects will be considered obstructions to air navigation (unless special aeronautical study indicates otherwise) if they are more than 500 feet aboveground or fall in the following categories.

a. Objects in approach-departure zone and below 1:10 glide angle that are more than 100 feet above the ground or 100 feet above the elevation of approach end of the runway or landing pad, whichever gives the higher elevation of the object.

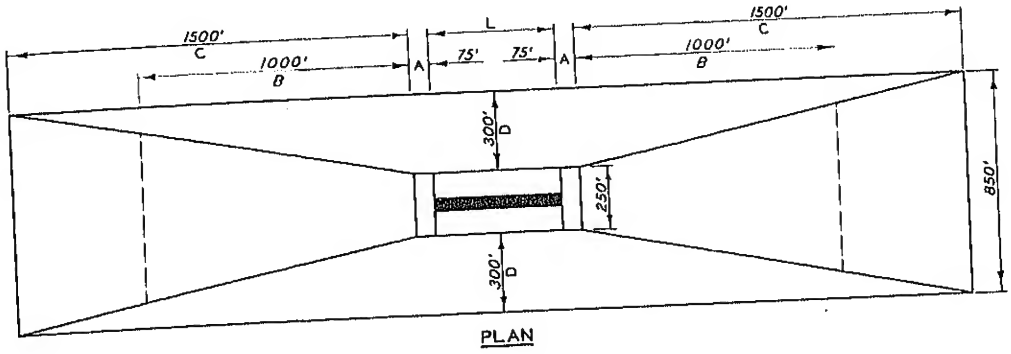
b. Objects protruding above heliport extended approach-departure surface beyond limits of standard approach-departure zone (1,500 feet). Objects beyond limits of standard approach-departure zone (1,500 feet) and extended approach-departure surface will be governed by airfield turning-zone criteria.

4. REMOVAL OF OBSTRUCTIONS. Natural and manmade obstructions will be removed where removal is both feasible and economical. Where such removal is not feasible or economical, obstructions will be lighted and marked in accordance with National Standards AGA-NS-3 and AGA-NS-4 contained in TM 5-823-4 (EM 1110-3-314).

5. PROTECTION OF AIRSPACE. Control over the use of land not under jurisdiction of the Department of the Army in order to prevent erection of obstructions to air navigation will be accomplished by:

a. Real estate action securing control of the necessary airspace by fee purchase or easement acquisition, or

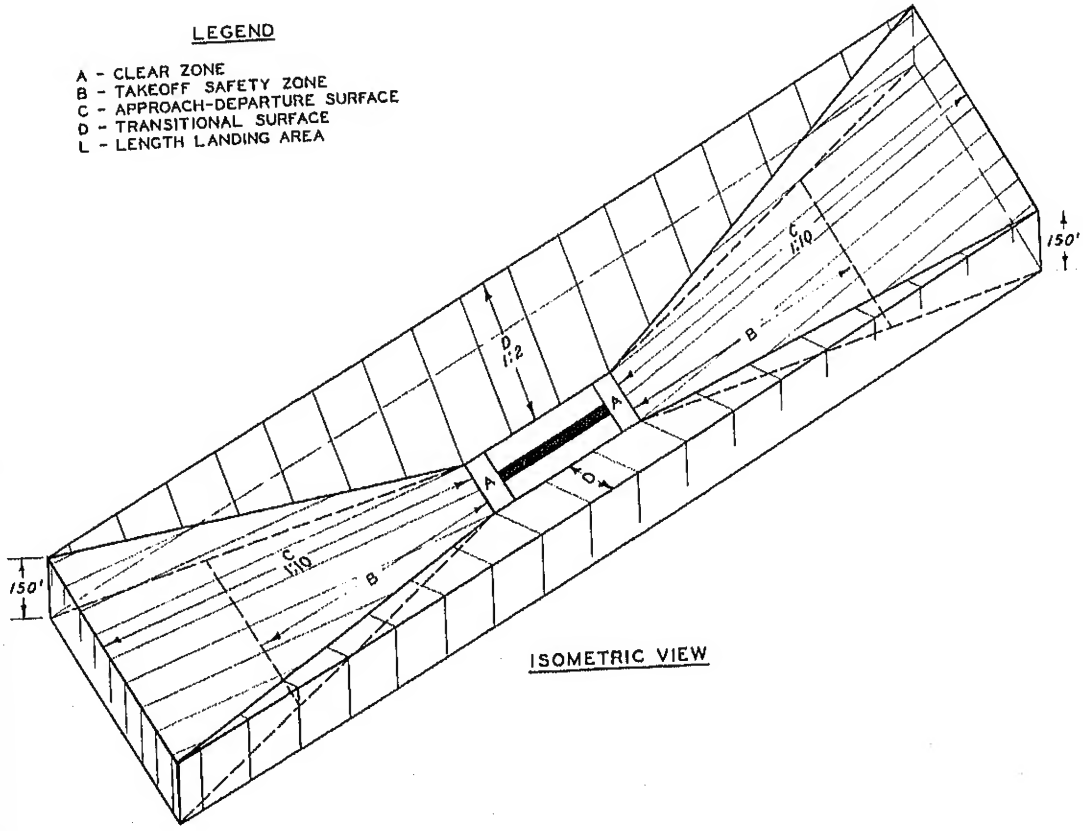
b. Zoning (see AR 210-94).



PLAN

LEGEND

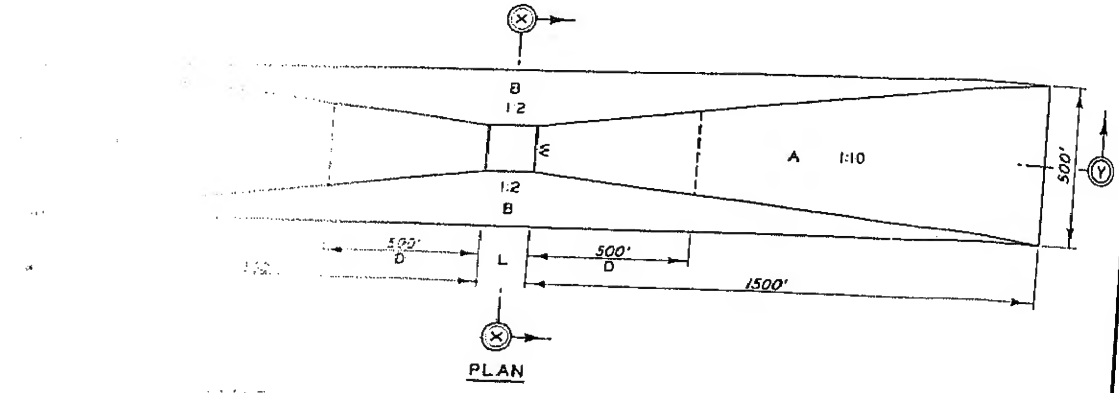
A - CLEAR ZONE
B - TAKEOFF SAFETY ZONE
C - APPROACH-DEPARTURE SURFACE
D - TRANSITIONAL SURFACE
L - LENGTH LANDING AREA



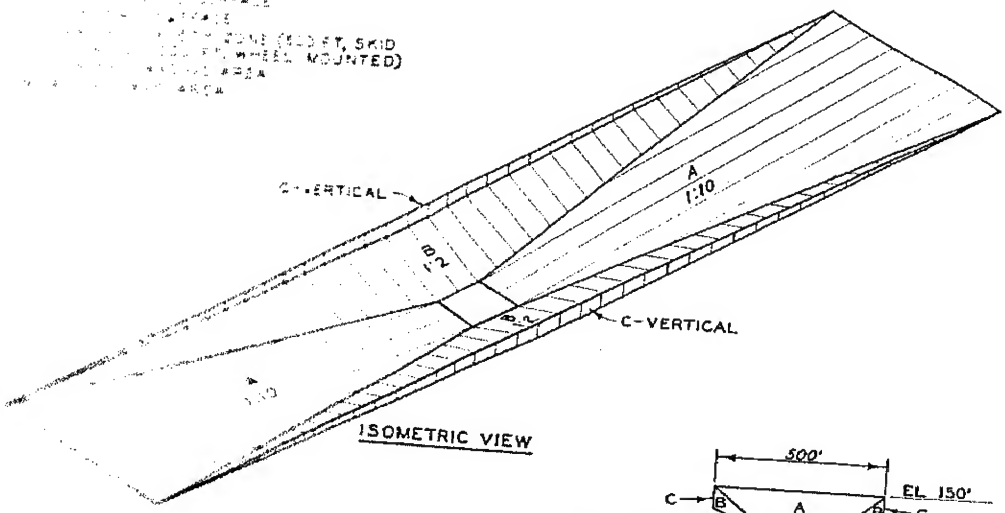
ISOMETRIC VIEW

HELIPORT AIRSPACE
CONTROL SURFACES
RUNWAY LANDING AREA

FIGURE VI-1

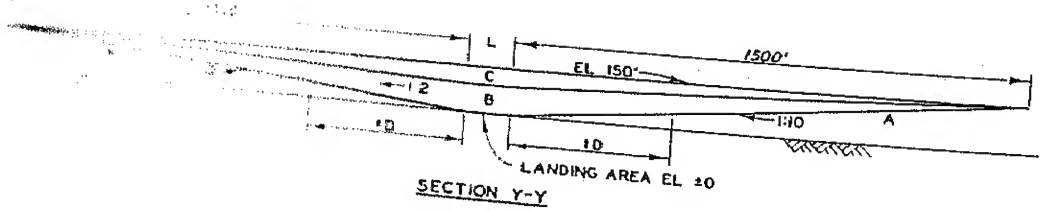


PLAN



ISOMETRIC VIEW

SECTION X-X



SECTION Y-Y

HELIPORT AIRSPACE CONTROL SURFACES
LANDING PAD AREA

By Order of the Secretary of the Army:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:
J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.